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FS-1-f6-6(2)
Aerial Spraying

STUDY PLAN FOR AERIAL SPRAYING OF BRUSHFIELDS
SUPPLEMENT NUMBER 1 - PLANTING

PROBLEM

This study is planned to help solve two problems: (1) To develop a method for planting successfully sites which are too steep for machines or otherwise unsuited to machine preparation and planting. (2) To reduce the cost of planting on sites which can be prepared and planted by machines.

PAST AND CURRENT WORK

This study is a cooperative effort of Forest Service Region 4 through the Division of Timber Management, the Boise National Forest through the Idaho City Ranger District, and the Intermountain Forest and Range Experiment Station including the Division of Forest Management Research in Ogden and the Boise Research Center. All of these cooperators have been active in developing planting methods for this region, particularly since the start of the Town Creek Planting Study in 1954. The present study will utilize the knowledge and talents each cooperator has developed from past projects in a combined effort to increase planting success and efficiency.

Five consecutive years of planting on the Town Creek Planting Study and administrative plantings on several national forests have shown that ponderosa pine can be planted successfully on many brushfields and timber-sale areas in central Idaho. Prior to the Town Creek study, which was

started in 1954, successful plantings in this region were almost nonexistent. Two things which contributed much to the successful plantings at Town Creek were complete elimination of competing vegetation in the site preparation and careful handling of the planting stock from the nursery through the planting. Site preparation consisted of stripping the vegetation with a D-7 tractor and dozer blade.

Although bulldozer stripping is successful, it is expensive and limited to slopes on which the tractor can operate safely on contour. Therefore, it is desirable to find a method to eliminate brush, grass, and sedge competition less expensively than stripping with a dozer, and to use on steep slopes. Aerial spraying of herbicides is being used in this test to replace dozer stripping.

Planting machines have been used in this region since 1957 with apparently good results. Planting sites are prepared the summer or fall prior to planting by plowing contoured furrows. A specially designed plow deposits all the soil on the downhill side of the furrow, leaving two tracks nearly level. The small tractor to which the planting machine is attached straddles the furrow, and the trees are planted in the bottom of the furrow.

John Deere "400" crawler tractors are used both for site preparation and planting. These small tractors are cheaper to operate than the large tractors used for stripping, and they can operate safely on steeper slopes. Machine planting is faster than hand planting, enabling more acres to be planted per season. Machine planting will be tested on the aerially sprayed plots along with hand planting.

Even if machine planting proves successful on fairly large tracts such as burns and on slopes up to 40 or 45 percent, they still will not solve all the planting problems. Many small clearcuts on timber sales and slopes steeper than 45 percent still must be hand planted.

In [this] summary, this test of hand planting and machine planting in brush-fields sprayed with herbicides uses the knowledge gained from the Town Creek Planting Study and subsequent plantings in the region. It is an attempt to duplicate the planting successes at Town Creek with methods which will reduce costs and which will apply to sites on which Town Creek methods cannot be used.

OBJECTIVES AND SCOPE

The immediate objectives of this study are to answer the following questions:

1. Will aerial spraying with herbicides reduce competition from brush, grass, and sedge sufficiently to permit hand planting ponderosa pine nursery stock without further site preparation?
2. Will aerial spraying with herbicides reduce competition from brush, grass, and sedge sufficiently to permit hand planting pine seedlings in tar paper containers without further site preparation?
3. Will the application of fertilizer pellets in planting holes increase survival and/or growth of hand-planted 2-1 nursery stock?
4. Will aerial spraying increase survival of pines planted by machines in furrows?

5. Will survival of planted trees be different on east and west aspects?
6. Will survival of planted trees be different on plots sprayed with four different formulations or concentrations of herbicides as described in the original study plan?

Observations will be made of the physical resistance to planting by the live and dead brush, especially different densities of brush. For example, if dense patches of brush are intentionally avoided in planting, how much will it reduce the stocking or distribution of trees? No specific measurements are planned for these observations.

METHODS

Variables being tested are the following:

1. Spray treatments--The four formulations or concentrations of herbicide sprays described in the original study plan plus an unsprayed plot comprise the five spray treatments.
2. Aspects--East and west aspects in each sprayed plot will be planted.
3. Planting methods--Each sprayed plot has been divided in half. The south half will be planted in contour furrows by planting machines. The north half will be planted by hand using the modified dug-hole method.
4. Stock--Three classes of stock will be planted in the hand-planted portions only; 2-1 nursery stock, 2-1 nursery stock with a fertilizer pellet planted beside each tree, and 2-year-old seedlings in tar paper containers. The machine planted portion of each plot will contain only 2-1 nursery stock without fertilizer.

Sampling Scheme

The four 10-acre sprayed blocks will be planted completely, half of each block being planted by hand and half by planting machine. However, survival and growth will be measured on sample plots or rows within the larger plots. Each sample plot will contain 100 planted trees, and plot locations will be selected on the basis of uniformity of site conditions within plots and between plots to be compared. Sample plots will be distributed in each of the four sprayed tracts and one unsprayed tract as follows:

Machine-planted portion--Two plots of 2-1 nursery stock on east aspects and two on west aspects.

Hand-planted portion--One plot each of 2-1 nursery stock, 2-1 nursery stock with fertilizer pellets, and 2-year seedlings in containers on east and west aspects.

Measurements

Survival counts on all plots will be made after the end of the growing season annually for 5 years, at which time a new remeasurement schedule will be determined.

Annual height growths will be measured only on a sub-sample of the hand-planted plots with fertilized and unfertilized nursery stock. On each of these plots 25 trees will be selected randomly, and the same trees will be measured each year. Height growths will be measured annually for 5 years, After 5 years a new remeasurement schedule will be determined.

Planted trees will be marked so they can be located easily for remeasurements. The precise method and extent of marking will be determined in the field when the shapes of the plots are known.

Analyses

Percent survival and annual height growth will be used to analyze differences under the various treatments. Two separate analyses are required to test all the treatments. The first will test differences in spray treatments, aspects, and planting method. Two replications are possible by using two sample plots on each aspect of each sprayed block as replicates. On the machine-planted portion both plots will contain 2-l stock unfertilized; the hand-planted portion will contain one plot fertilized and one unfertilized. Analysis of variance will take the following form:

| <u>Source</u> | <u>D.f.</u> |
|---------------|-------------|
| Spray | 4 |
| Aspect | 1 |
| Method | 1 |
| Replication | 1 |
| S - A | 4 |
| S - M | 4 |
| A - M | 1 |
| S - A - M | 4 |
| Error | <u>19</u> |
| Total | 39 |

It is recognized that the planting methods and aspects could not be randomly assigned within the blocks. This weakens the reliability of the analysis.

The second analysis, which will use only the hand-planted plots, will test differences in spray treatment, aspect, and class of stock. No replication is possible because only one plot of containers, 2-l stock, and fertilized stock will be available on each aspect of each sprayed block. Analysis of variance will take the following form:

| Source of variation | : Degrees of freedom | : Sum of squares | : Mean square | : F |
|---------------------|----------------------|------------------|---------------|-----|
| Spray | 4 | | | |
| Aspect | 1 | | | |
| Class of stock | 2 | | | |
| S x A | 4 | | | |
| S x C | 8 | | | |
| A x C | 2 | | | |
| Error (S x A x C) | <u>8</u> | | | |
| Total | 29 | | | |

ASSIGNMENTS

Boise National Forest crews will plant the plots during the 1960 planting season, probably in late April or early May.

Forest Service Region 4 and the Boise Forest will supply the planting stock from the nursery at Bend, Oregon, the machinery and equipment for planting, and the fertilizer pellets in addition to the planting labor.

Boise Research Center will supply the seedlings in tarpaper containers for planting.

The Forest Management Division and the Boise Research Center of the Intermountain Forest and Range Experiment Station will be responsible for locating and marking the sample plots and for subsequent remeasurements, analyses, and reports of results from the study.

Submitted:

Marvin H. Foiles

4/11/60

Date

Approved:

Paul W. Lynch

Center Leader, Boise Research Center

4-11-60

Date

Charles G. Wellner

Chief, Division of Forest Management Res.

4/13/60

Date

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PLANTATION PLOT SURVIVAL

| Plot no. | Spray treatment | Aspect | Stock | Planting method | Number of trees planted | Survival - live trees | | | | |
|----------|-----------------|--------|-------|-----------------|-------------------------|-----------------------|------|------|------|------|
| | | | | | | 1960 | 1961 | 1962 | 1963 | 1964 |
| | | | | | | (Number) | | | | |
| 1 | Check | E | 2-1 | Mach. | 100 | | | | | |
| 2 | Check | E | 2-1 | Mach. | 100 | | | | | |
| 3 | Check | W | 2-1 | Mach. | 100 | | | | | |
| 4 | Check | W | 2-1 | Mach. | 100 | | | | | |
| 5 | 5 gal. | E | 2-1 | Mach. | 100 | | | | | |
| 6 | 5 gal. | E | 2-1 | Mach. | 100 | | | | | |
| 7 | 5 gal. | W | 2-1 | Mach. | 100 | | | | | |
| 8 | 5 gal. | W | 2-1 | Mach. | 100 | | | | | |
| 9 | 8 + Dal. | E | 2-1 | Mach. | 100 | | | | | |
| 10 | 8 + Dal. | E | 2-1 | Mach. | 100 | | | | | |
| 11 | 8 + Dal. | W | 2-1 | Mach. | 100 | | | | | |
| 12 | 8 + Dal. | W | 2-1 | Mach. | 100 | | | | | |
| 13 | 8 gal. | E | 2-1 | Mach. | 100 | | | | | |
| 14 | 8 gal. | E | 2-1 | Mach. | 100 | | | | | |
| 15 | 8 gal. | W | 2-1 | Mach. | 100 | | | | | |
| 16 | 8 gal. | W | 2-1 | Mach. | 100 | | | | | |
| 17 | 3 gal. | E | 2-1 | Mach. | 100 | | | | | |
| 18 | 3 gal. | E | 2-1 | Mach. | 100 | | | | | |
| 19 | 3 gal. | W | 2-1 | Mach. | 100 | | | | | |
| 20 | 3 gal. | W | 2-1 | Mach. | 100 | | | | | |
| 23 | Check | E | Cont. | Hand | 100 | | | | | |
| 26 | Check | W | Cont. | Hand | 100 | | | | | |
| 29 | 5 gal. | E | Cont. | Hand | 100 | | | | | |
| 32 | 5 gal. | W | Cont. | Hand | 100 | | | | | |
| 35 | 8 + Dal. | E | Cont. | Hand | 100 | | | | | |
| 38 | 8 + Dal. | W | Cont. | Hand | 100 | | | | | |
| 41 | 8 gal. | E | Cont. | Hand | 100 | | | | | |
| 44 | 8 gal. | W | Cont. | Hand | 100 | | | | | |
| 47 | 3 gal. | E | Cont. | Hand | 100 | | | | | |
| 50 | 3 gal. | W | Cont. | Hand | 100 | | | | | |

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PLANTATION PLOT SURVIVAL AND HEIGHT GROWTH

Plot No. _____

| Spray treatment | Aspect | Stock | Planting method | Fertilizer | Number of trees planted | Height tree number | Survival - live trees | | | | |
|-----------------|--------|-------|-----------------|------------|-------------------------|--------------------|--|------|------|------|------|
| | | | | | | | 1960 | 1961 | 1962 | 1963 | 1964 |
| Check | E | 2-1 | Hand | Pellets | 100 | | | | | | |
| | | | | | | | (Number) | | | | |
| | | | | | | | Annual height growth (Feet and tenths) | | | | |
| | | | | | | | 1 | | | | |
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| | | | | | | | 24 | | | | |
| | | | | | | | 25 | | | | |
| | | | | | | | Total Average | | | | |